

National Aeronautics and Space Administration



OFFICE OF THE CHIEF TECHNOLOGIST



Dr. Bobby Braun
NASA Chief Technologist

OCT Overview Presentation
October 2010

Themes of the President's FY11 NASA Budget Request



- **Technology Development is a strong theme across the President's FY11 NASA budget request**
 - Central principle of new Human Exploration strategy
 - Reverse of past decline and modest increase for Aeronautics (~15% or \$75M/yr)
 - Mission-focused technology investments maintained within the Science Mission Directorate
 - Utilization of ISS for technology development by the Space Operations Mission Directorate
 - New ARPA-like Space Technology Program (\$5B over 5 years)
- **This renewed emphasis balances the long-standing NASA core competencies of R&T, spaceflight hardware development, and mission operations.**
- **Increased emphasis on partnerships and STEM education**
 - Other government agencies, academia, industry and international
 - Theme of National Space Policy
- **Overarching goal is to reposition NASA on the cutting-edge**

Office of Chief Technologist Roles/Responsibilities



- **OCT established in February 2010**
- **OCT has six main goals and responsibilities:**
 - 1) Principal NASA advisor and advocate on matters concerning Agency-wide technology policy and programs.
 - 2) Up and out advocacy for NASA research and technology programs. Communication and integration with other Agency technology efforts.
 - 3) Direct management of Space Technology Programs.
 - 4) Coordination of technology investments across the Agency, including the mission-focused investments made by the NASA mission directorates. Perform strategic technology integration.
 - 5) Change culture towards creativity and innovation at NASA Centers, particularly in regard to workforce development.
 - 6) Document/demonstrate/communicate societal impact of NASA technology investments. Lead technology transfer and commercialization opportunities across Agency.
- Mission Directorates manage the mission-focused technology programs for directorate missions and future needs
- Beginning in FY 2011, activities associated with the Innovative Partnerships Program are integrated into the Office of the Chief Technologist

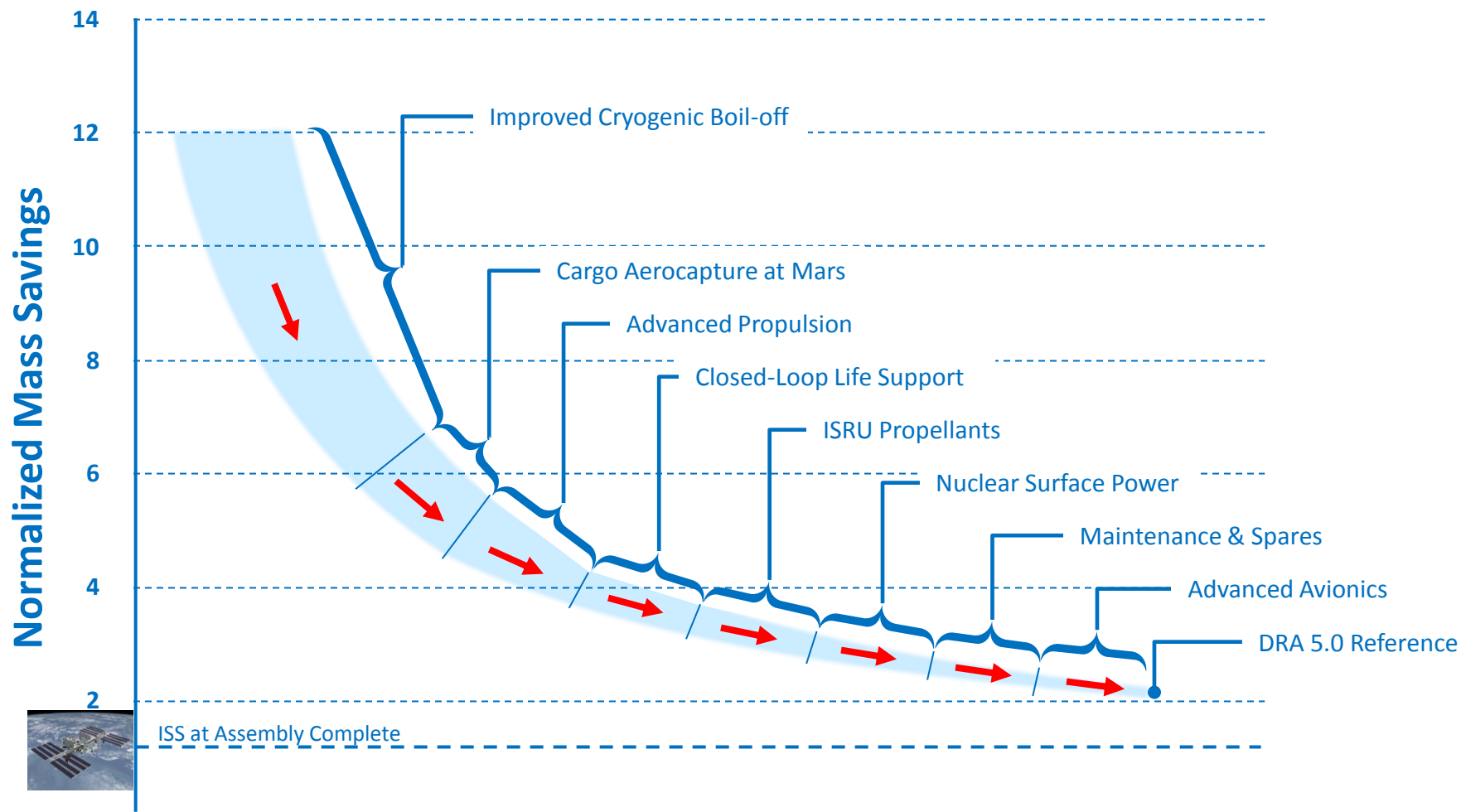
- **Space Technology is a new budget line in the President's FY11 Budget Request for NASA**
 - Consists of 10 technology development and innovation programs that are broadly applicable to the Agency's aeronautics, science and exploration enterprises
 - Managed by Office of the Chief Technologist (OCT)
- **OCT has chosen to manage these 10 programs through the formation of 3 Divisions**
 - Early Stage Innovation
 - Game Changing Technology
 - Crosscutting Capability Demonstrations
- **Space Technology builds on the success of NASA's Innovative Partnerships Program (IPP)**
 - In FY11, IPP is integrated into Office of the Chief Technologist and the IPP budget is integrated into the Space Technology Program

External Input Has Driven Formulation of the NASA Space Technology Program



- **NASA Authorization Act of 2008:** *“A robust program of long-term exploration-related research and development will be essential for the success and sustainability of any enduring initiative of human and robotic exploration of the solar system.”*
- **NRC report, A Constrained Space Exploration Technology Program: A Review of NASA’s ETDP, 2008:** *“NASA has created a supporting technology program very closely coupled to the near-term needs of the Constellation Program. This program contains only incremental gains in capability and two programmatic gaps. NASA has effectively suspended research in a number of technology areas traditionally within the agency’s scope. This could have important consequences for those portions of the VSE beyond the initial short-duration lunar missions, including extended human presence on the Moon, human exploration of Mars, and beyond.”*
- **NRC report, America’s Future in Space, 2009:** *“NASA should revitalize its advanced technology development program by establishing a DARPA-like organization within NASA as a priority mission area to support preeminent civil, national security (if dual-use), and commercial space programs.”*
- **NRC report, Fostering Visions for the Future: A Review of the NASA Institute for Advanced Concepts, 2009:** *“To improve the manner in which advanced concepts are infused into its future systems, the committee recommends that NASA consider reestablishing an aeronautics and space systems technology development enterprise. Its purpose would be to provide maturation opportunities and agency expertise for visionary, far-reaching concepts and technologies.”*
- **Augustine Committee, 2009:** *“The Committee strongly believes it is time for NASA to reassume its crucial role of developing new technologies for space. Today, the alternatives available for exploration systems are severely limited because of the lack of a strategic investment in technology development in past decades.”*
- **NRC report, Capabilities for the Future: An Assessment of NASA Laboratories for Basic Research, 2010:** *“To restore the health of the fundamental research laboratories, including their equipment, facilities, and support services, NASA should restore a better funding and leadership balance between long-term fundamental research/technology development and short- term mission-focused applications.”*

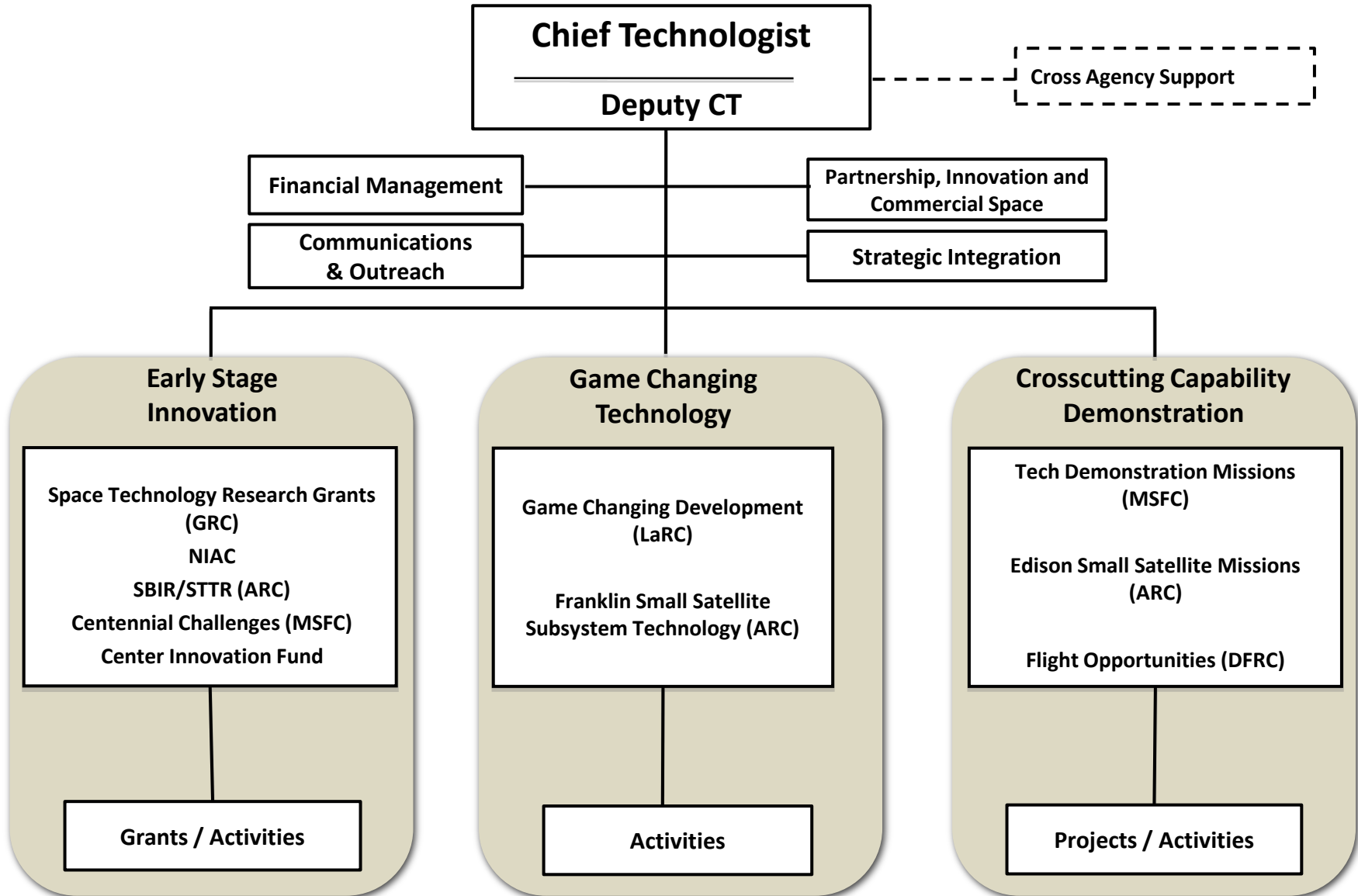
The Value of Technology Investments Mars Mission Example*



- Without technology investments, the mass required to initiate a human Mars mission in LEO is approximately twelve times the mass of the International Space Station
- Technology investments of the type proposed in the FY 2011 budget are required to put such a mission within reach

* The ordering and impact of these technologies are an example valid for one particular architecture and is not intended as an architecture endorsement nor technology development prioritization

Office of the Chief Technologist Organization



Space Technology: A Different Approach

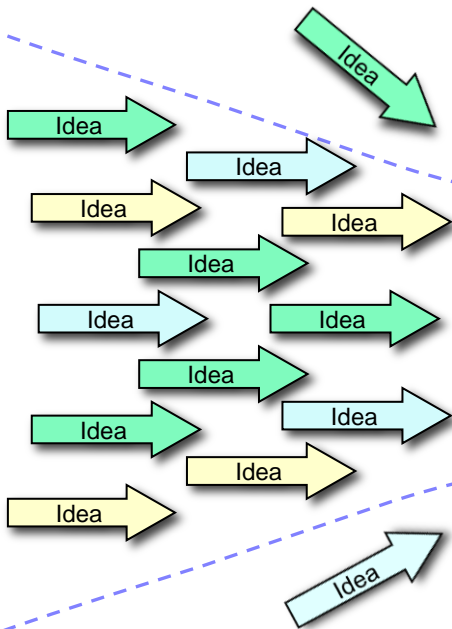


- **Strategic Guidance**
 - Agency Strategic Plan
 - Grand challenges
 - Technology roadmaps
- **Full spectrum of technology programs that provide an infusion path to advance innovative ideas from concept to flight**
- **Competitive peer-review and selection**
 - Competition of ideas building an open community of innovators for the Nation
- **Projectized approach to technology development**
 - Defined start and end dates
 - Project Managers with full authority and responsibility
 - Project focus in selected set of strategically defined capability areas
- **Overarching goal is to reposition NASA on the cutting-edge**
 - Technical rigor
 - Pushing the boundaries
 - Take informed risk and when we fail, fail fast and learn in the process
 - Seek disruptive innovation such that with success the future will no longer be a straight line
 - Foster an emerging commercial space industry

Space Technology Development Approach

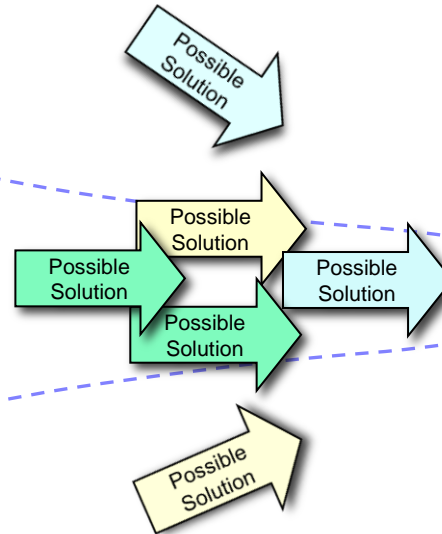


Visions of the Future



- Industry
- Academia
- Gov't

Does it WORK?



Is it Flight Ready?

Infusion Opportunities for NASA Mission Directorates, Other Govt. Agencies, and Industry



Creative ideas regarding future NASA systems or solutions to national needs.



Prove feasibility of novel, early-stage ideas with potential to revolutionize a future NASA mission and/or fulfill national need.



Mature crosscutting capabilities that advance multiple future space missions to flight readiness status



The Early Stage Innovation Division sponsors a wide range of low TRL efforts for advanced space system concept and initial technology development across academia, industry and at the NASA field Centers.

Early Stage Innovation includes:

- **Space Technology Research Grants Program** focuses on innovative research in advanced space technology grants & graduate fellowships for student research in space technology
- **NIAC Program** focuses on innovative aeronautics and space system concepts for future NASA missions
- **Center Innovation Fund Program** stimulates aerospace creativity and innovation at the NASA field Centers
- **SBIR/STTR Program** engages small businesses in our Nation's space enterprise and infuse these products across NASA missions
- **Centennial Challenges Prize Program** addresses key technology needs with new sources of innovation outside the traditional aerospace community

All Early Stage Innovation selections will be made competitively

Game Changing Technology Division



- *The Game Changing Technology Division focuses on maturing advanced space technologies that may lead to entirely new approaches for the Agency's future space missions and solutions to significant national needs.*
- *Through significant ground-based testing and/or laboratory experimentation, the Game Changing Technology Division matures technologies in preparation for potential system level flight demonstration. Success is not assured with each investment; however, on the whole and over time, dramatic advances in technology, enabling entirely new NASA missions and potential solutions for a variety of society's technological challenges are expected.*
- *A broad spectrum of space system technologies will be developed ranging from launch vehicle subsystems, spacecraft technologies, in-space capabilities, and surface systems that support robotic and human exploration.*

Game Changing Technology Division includes:

- **Game Changing Development Program** focuses on innovative ideas enabling new capabilities or radically altering our current approaches to space systems
- **Franklin Small Satellite Subsystem Technology Program** enables small satellites to provide game changing capabilities for the space sectors

**Greater than 70% of GCT funds (FY11-FY15) will
applied to competitive selections**

Crosscutting Capability Demonstrations Division



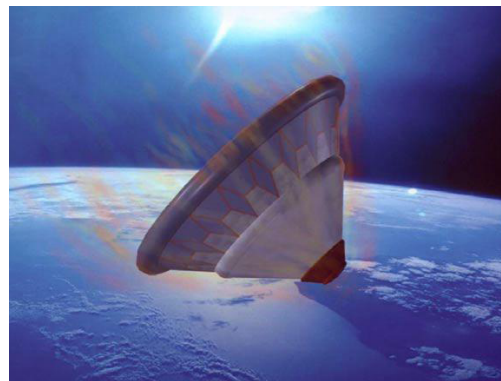
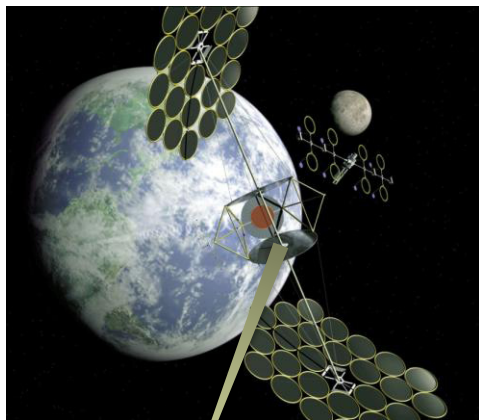
- *The Cross-Cutting Capability Demonstrations Division focuses on maturation to flight readiness of cross-cutting capabilities that advance multiple future space missions, including flight test projects where in-space demonstration is needed before the capability can transition to direct mission application.*
- *Matures a small number of technologies that benefit multiple customers to flight readiness status (TRL 6) through Projects that perform relevant environment testing.*

Crosscutting Capability Demonstrations Division includes:

- **Technology Demonstration Missions Program** matures, through flight demonstrations, a small number of Agency crosscutting technologies in partnerships with the Mission Directorates, industry, and other government agencies
- **Edison Small Satellite Missions Program** develops and operates a series of NASA-focused small satellite demonstration missions in collaboration with academia and small business
- **Flight Opportunities Program** provides flight opportunities of reduced-gravity environments, brief periods of weightlessness, and high-altitude atmospheric research

Greater than 70% of CCD funds (FY11-FY15) will be applied to competitive selections

Potential Space Technology Demonstrations



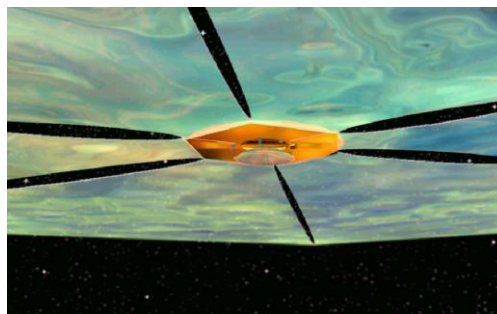
Inflatable Decelerators



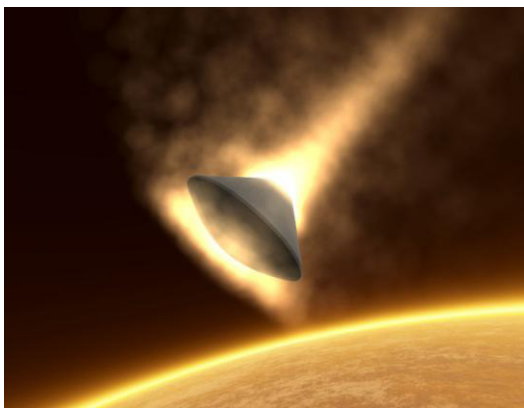
25-40 m Class Telescopes



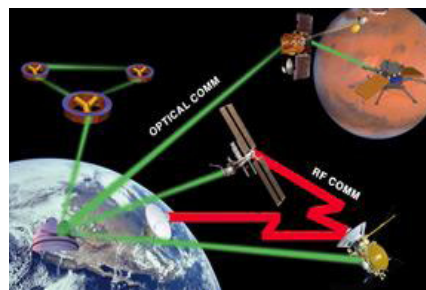
**Space Solar Power:
In-Space Power
Transmission**



Solar Sail Propulsion



Aerocapture



Optical Communications



**Electrodynamic
Tether Propulsion**
Artist Concept of ISS
Reboost

Space Technology Engagement with External Community To Date



- **Three Space Technology Programs - SBIR/STTR and Centennial Challenges and Flight Opportunities are proceeding with standard cycle of external engagements as part of FY10 NASA IPP activities.**
- **On May 4, 2010, OCT released a NASA Technology Research Fellowship letter to NASA Field Centers and Federal Laboratories requesting research area topics.**
- **OCT issued on May 25, 2010, three RFIs for the Technology Demonstration Missions Program, the Edison Small Satellite Missions Program, and the Small Satellite Subsystem Technology Program.**
- **Space Technology Industry Day on July 13-14, 2010**
- **OCT issued on August 24, 2010, three RFIs for the Space Technology Research Grants Program, the Game Changing Development Program, and the NASA Innovative Advanced Concepts Program.**
- **Internal program formulation process is proceeding on pace to allow release of Space Technology solicitations in early fall pending Congressional approval.**

NASA: Part of a Broader National Strategy



- As evidenced in its FY11 budget request, the Obama administration is committed to a research, technology and innovation agenda for the Nation as a means of stimulating the economy and building our Nation's global economic competitiveness through the creation of new products and services, new business and industries, and high-quality, sustainable jobs .
- The NASA budget request is aligned with this National strategy.
 - A renewed technology emphasis balances NASA's long-standing core competencies of research and technology, spaceflight hardware development, and mission operations.
 - An enhanced technology and innovation focus at NASA responds to the recommendations of multiple external stakeholders.
- Pushing the boundaries and taking informed-risk, NASA's new Space Technology Program will develop crosscutting, game-changing solutions to the Agency's technological needs.
- In addition to providing a more more vital and productive aerospace future than our country has today, a NASA focused on technology and innovation,
 - Drives our Nation's economic competitiveness.
 - Serves as a strong inspiration for young people to pursue STEM education and career paths.
 - Allows NASA to apply its intellectual capital to the develop technological solutions addressing broader National needs in energy, weather & climate, health & wellness, and National security.

I am 100 percent committed to the mission of NASA and its future. Because broadening our capabilities in space will continue to serve our society in ways we can scarcely imagine. Because exploration will once more inspire wonder in a new generation: sparking passions, launching careers. And because, ultimately, if we fail to press forward in the pursuit of discovery, we are ceding our future. President Obama, April 15, 2010.